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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/521,191	01/12/2005	Takashi Yokokawa	09812.0201	8642

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FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER  
LLP  
901 NEW YORK AVENUE, NW  
WASHINGTON, DC 20001-4413

EXAMINER
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RIZK, SAMIR WADIE

ART UNIT	PAPER NUMBER
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2133

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	03/16/2007	PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/521,191	<b>Applicant(s)</b> YOKOKAWA ET AL.	
	<b>Examiner</b> Sam Rizk	<b>Art Unit</b> 2133	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 19 December 2006.
- 2a) ☐ This action is FINAL.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

  
**GUY LAMARRE**  
**PRIMARY EXAMINER**

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 17 July 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                       | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

### DETAILED ACTION

- Response to the applicant's amendment dated 11/20/2006
- Amended claims 1, 4 and 20 and claims 2,3,5-19 have been submitted for examination
- Claims 1-20 have been rejected

### *Response to Arguments*

1. Applicant's arguments with respect to claims 1, 4 and 20 have been considered but are moot in view of the new ground(s) of rejection.

### *Claim Rejections - 35 USC § 102*

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1-7, 18 and 20 are rejected under 35 U.S.C. 102(e) as being anticipated by Song et al. US patent no. 7058873 (Hereinafter Song).
3. In regard to claim 1, Song teaches:  
  
(Currently Amended) A decoding method of decoding Low Density Parity Check ("LDPC") codes, the LDPC codes being represented by an original check matrix, said decoding method comprising:  
an obtaining step of permuting at least two columns or two rows of the original check matrix to obtain a transformation check matrix (Figures 3A & 4 and col. 5, lines 22-30 in Song) ; and

a decoding step of decoding said LDPC codes by using the obtained transformation check matrix (FIG. 2, reference character (30) in Song).

4. In regard to claim 2, Song teaches:

(Previously Presented) The decoding method according to claim 1, wherein by using, as a formation matrix, a  $P \times P$  unit matrix (FIG. 4, rows (0-7) & col.'s (0-7) in Song), a quasi-unit matrix in which one or more 1s, which are elements of the unit matrix, are substituted with 0 (col. 5, lines (19-21) in Song), a shift matrix in which said unit matrix or said quasi-unit matrix is cyclically shifted (col. 6, line 14 in Song), a sum matrix, which is the sum of two or more of said unit matrix, said quasi-unit matrix, and said shift matrix, and a  $P \times P$  0-matrix (col. 3, line 22 in Song), said transformation check matrix is represented by a combination of a plurality of said formation matrices (Col. 6, lines (1-35) in Song).

5. In regard to claim 3, Song teaches:

(Previously Presented) The decoding method according to claim 1, further comprising:  
a code sequence permutation step of performing, on the code sequence of said received LDPC codes, the same column permutation as the column permutation performed on said original check matrix and outputting a permuted code sequence, wherein  
in said decoding step, said code sequence is decoded by using said transformation check matrix and said permuted code sequence.  
(Note: FIG. 5 in Song)

6. Claim 4 is rejected for the same reasons as per claim 1.

7. Claim 5 is rejected for the same reasons as per claim 2.

8. In regard to claim 6, Song teaches:

(Original) The decoding apparatus according to claim 5, wherein said decoding means comprises:  
check node calculation means for simultaneously performing  $p$  check

node computations for decoding said LDPC codes; and  
variable node calculation means for simultaneously performing p  
variable node computations for decoding said LDPC codes.

(Note; FIG. 8 and col. 7, lines (55-65) in Song)

The Examiner notes that the "bit node" in Song is same as the "variable node"  
referred to in the instant application.

9. In regard to claim 7, Song teaches:

(Previously Presented) The decoding apparatus according to claim 6,  
wherein said check node calculation means comprises p check node  
calculators for performing computations of check nodes; and  
said variable node calculation means comprises p variable node  
calculators for performing computations of variable nodes.

(Note: col. 8, lines (15-17) in Song)

10. In regard to claim 18, Song teaches:

(Previously Presented) The decoding apparatus according to claim 4,  
further comprising:  
code sequence permutation means for performing, on the code  
sequence of said received LDPC codes, the same column permutation  
as the column permutation performed on said original check matrix and  
outputting a permuted code sequence, wherein  
said decoding means decodes said code sequence by using said  
transformation check matrix and said permuted code sequence.

(Figures 3A & 4 and col. 5, lines 22-30 in Song)

11. Claim 20 is rejected for the same reasons as per claim 1.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
  2. Ascertaining the differences between the prior art and the claims at issue.
  3. Resolving the level of ordinary skill in the pertinent art.
  4. Considering objective evidence present in the application indicating obviousness or nonobviousness.
12. Claims 8-14 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Song as applied to claim 6 above, and further in view of Richardson et al. US patent 6633856 (Hereinafter Richardson).
13. In regard to claim 8, Song substantially teaches all the limitations in claim 6. However, Song does not teach;
- (Original) The decoding apparatus according to claim 6, wherein said decoding means further comprises message storage means for simultaneously reading and writing message data corresponding to p edges obtained as a result of said computations of the p check nodes or the p variable nodes.

Richardson in an analogous art that teaches method and apparatus for decoding

LDPC codes teaches:

(Original) The decoding apparatus according to claim 6, wherein said decoding means further comprises message storage means for simultaneously reading and writing message data corresponding to p edges obtained as a result of said computations of the p check nodes or the p variable nodes.

(Note: Figure 15, reference character (1506) in Richardson)

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teaching of Song that encoding and decoding a low density parity check code with column weight of two with the teaching of Richardson.

This modification would have been obvious to one of ordinary skill in the art, at the time the invention was made, because one of ordinary skill in the art would have recognized the need for techniques, which will allow the message passing to be performed in parallel, thereby allowing large codewords to be efficiently decoded.

14. In regard to claim 9, Song teaches:

(Original) The decoding apparatus according to claim 8, wherein said message storage means stores message data corresponding to the edges which are read during a check node computation in such a manner that is of said transformation check matrices are padded closer in the row direction.

(Note: Figure 15, reference character (1504) in Richardson)

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15. In regard to claim 10, Richardson teaches:

(Original) The decoding apparatus according to claim 8, wherein said message storage means stores message data corresponding to the edges which are read during a variable node computation in such a manner that is of said transformation check matrix is padded closer in the column direction.

(Note: Figure 15, reference character (1504) in Richardson)

16. In regard to claim 11, Richardson teaches:

(Original) The decoding apparatus according to claim 8, wherein said message storage means stores, at the same address, messages corresponding to  $p$  edges belonging to a unit matrix, a quasi-unit matrix, or a shift matrix whose weight is 1 when the formation matrices, whose weight is 2 or more, representing said transformation check matrix are represented in the form of the sum of the unit matrix, the quasi-unit matrix, or the shift matrix, whose weight is 1.

(Note: Figure 16, reference characters (1606) and (1607) in Richardson)

17. In regard to claim 12, Richardson teaches:

(Previously Presented) The decoding apparatus according to claim 8, wherein said message storage means comprises number-of-the-rows/ $p$  FIFOs and number-of-the-columns/ $p$  FIFOs; and said number-of-the-rows/ $p$  FIFOs and said number-of-the-columns/ $p$  FIFOs each have a number of words corresponding to the weight of the rows and columns of said check matrix, respectively.

(Note; col. 25, lines (39-45) in Richardson)



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18. In regard to claim 13, Richardson teaches:

(Previously Presented) The decoding apparatus according to claim 8, wherein said message storage means comprises a Random Access Memory ("RAM"), and said RAM stores said message data in such a manner as to be padded closer in the read-out sequence and reads said message data in the storage position sequence.

(Note: Figure 15, reference character (1506) in Richardson)

19. In regard to claim 14, Richardson teaches:

(Original) The decoding apparatus according to claim 6, wherein said decoding means further comprises received information storage means for storing received information and simultaneously reading p pieces of the received information.

(Note: Figure 15, reference character (1506) in Richardson)

20. In regard to claim 15, Richardson teaches:

(Original) The decoding apparatus according to claim 14, wherein said received information storage means stores said received information in such a manner that said received information can be read in the sequence necessary for said computations of variable nodes.

(Note: Figure 16, reference character (1618) in Richardson)

21. In regard to claim 16, Richardson teaches:

(Original) The decoding apparatus according to claim 6, wherein said decoding means further comprises cyclic shift means for cyclically shifting messages obtained as a result of said p check node computations or said p variable node computations.

(Note: Abstract, lines (15 & 16) in Richardson)

22. In regard to claim 17, Richardson teaches:

(Original) The decoding apparatus according to claim 16, wherein said cyclic shift means comprises a barrel shifter.

(Note: Figure 16, reference character (1604) in Richardson)

23. In regard to claim 19, Richardson teaches:

(Previously Presented) The decoding apparatus according to claim 18, further comprising:  
inverse permutation means for performing, on the output of said decoding means, an inverse permutation of a column permutation performed on said original check matrix, and for outputting a final decoded result.

(Note: col. 25, line 23 in Richardson)

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sam Rizk whose telephone number is (571) 272-8191. The examiner can normally be reached on M-F 8-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Albert Decady can be reached on (571) 272-3819. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

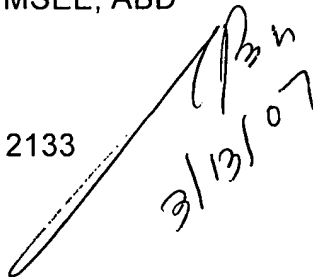
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Sam Rizk, MSEE, ABD

Examiner

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 3/13/07